



TMDL Overview

Lake Tahoe TMDL Symposium

Presented by:

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Lahontan RWQCB**



Presentation Overview

- **Provide overview of TMDL program**
- **Introduce the TMDL development phases**
- **Discuss the use of Clarity Model for development of load reduction strategies**
- **Discuss the use of planning tools and their potential use in Implementation and Allocation Planning**



TMDL Background

Total Maximum Daily Load = Water Quality Restoration Plan

- ✓ Mandated by Federal Clean Water Act since 1972
- ✓ Section 303(d) of the CWA requires states to identify and list impaired surface waters



Parts of a TMDL

- **Problem Statement**
- **Numeric Target**
- **Source Analysis**
- **Linkage Analysis**
- **Margin of Safety**
- **Pollutant Load Allocations**
- **Implementation Plan (CA)**
- **Monitoring Plan**



TMDL Development Phases

Phase I

Product: Technical TMDL

- Determines Current Loading
- Determines Basin-wide Load Reduction Needs

Phase II

Product: Final TMDL

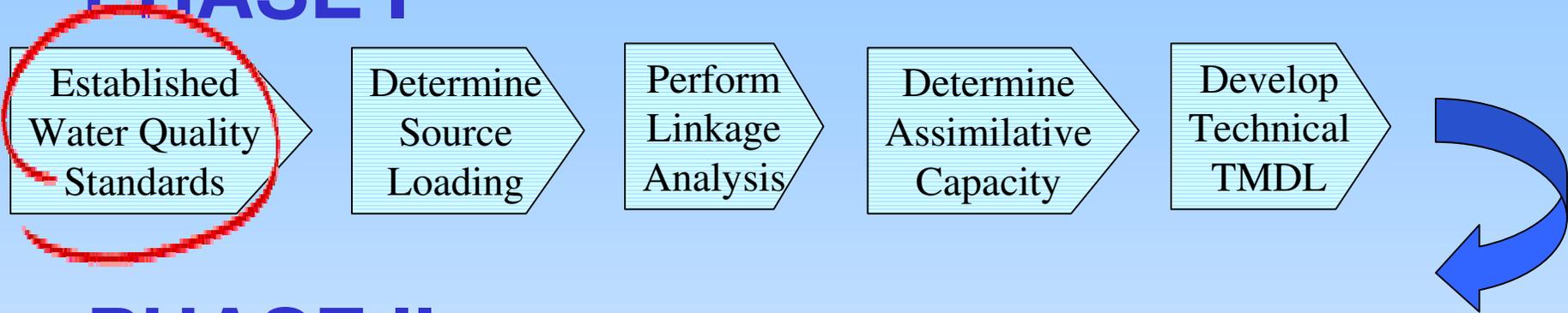
- Identify Load Reduction Possibilities
- Allocates Pollutant Load Reductions
- Implementation Plan
- TMDL Implementation Tool Box

Phase III

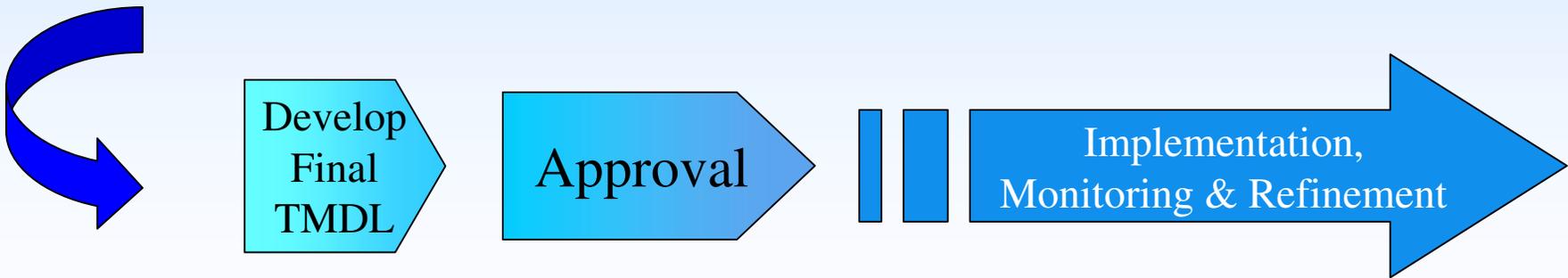
Product: Implementation and Monitoring

- Basin-wide Management System
- Adaptive Management System

PHASE I



PHASE II



PHASE III

Established Water Quality Objectives

Lahontan

***Secchi disk transparency shall not be decreased below the levels recorded in 1967-71
= 30 meters (~ 97 ft.)***

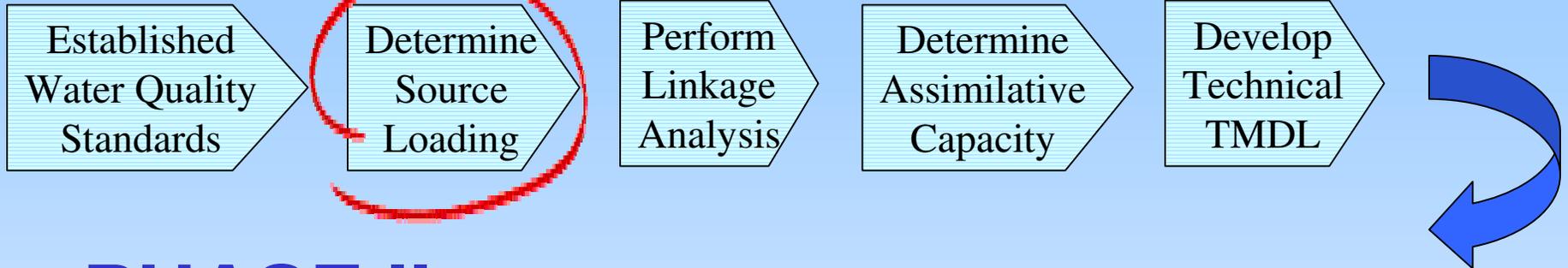
TRPA

Winter (December-March) mean Secchi disk transparency: 33.4m. (~ 110 ft.)

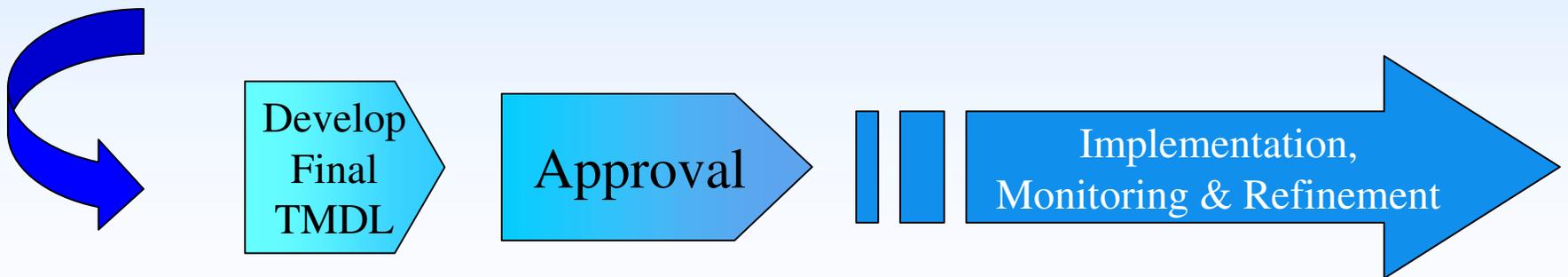
NDEP/Lahontan

The vertical extinction coefficient must be less than 0.08 per meter when measured at any depth below the first meter

PHASE I



PHASE II



PHASE III

Major Source Categories

Atmospheric

- **By primary source**
- **In-basin vs. out-of-basin**

Upland

- **Urban - commercial, residential, transportation, recreation**
- **Forested - undisturbed, roads/trail, fire, ski areas, management action**

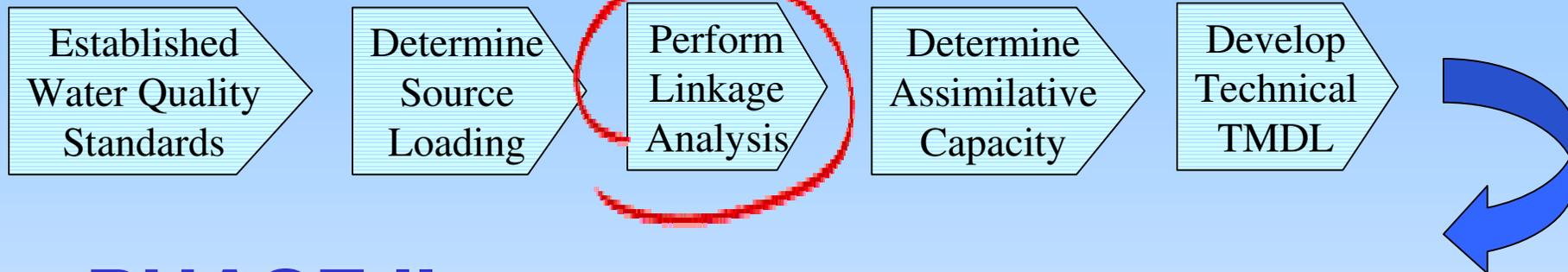
Groundwater

Stream Channel Erosion

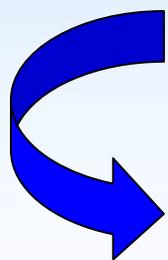
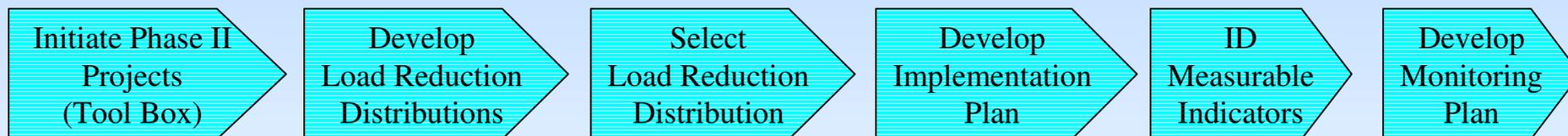
- **Load predictions from all 63 tributaries**

*** Fine Particle loadings for all sources types**

PHASE I



PHASE II



PHASE III

Linkage Models

Atmospheric

- UCD - MM5 historic climate reconstruction

Upland

- Tetra Tech - LSPC (Hydrology and Loading)
- Hydroikos - Statistical Modeling
- Geosyntec - SWMM (Pilot BMP modeling)

Groundwater

- USACE - groundwater loading model

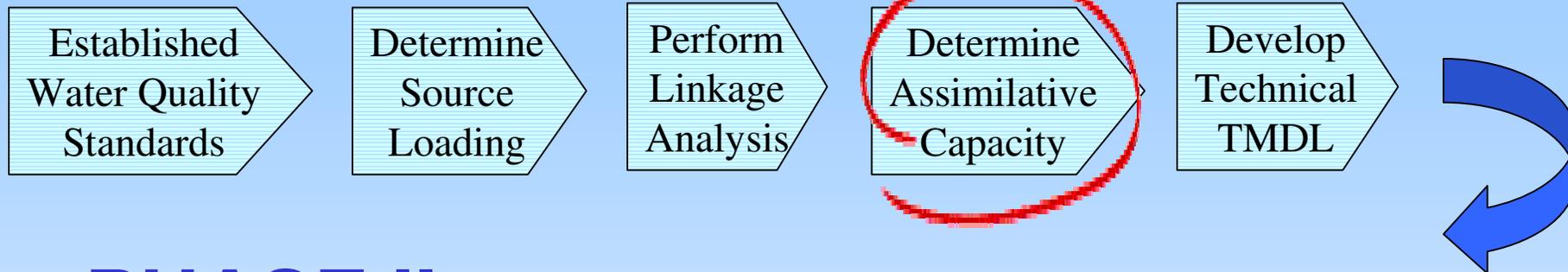
Stream Channel Erosion

- National Sedimentation Laboratory - CONCEPTS/AnnAGNPS

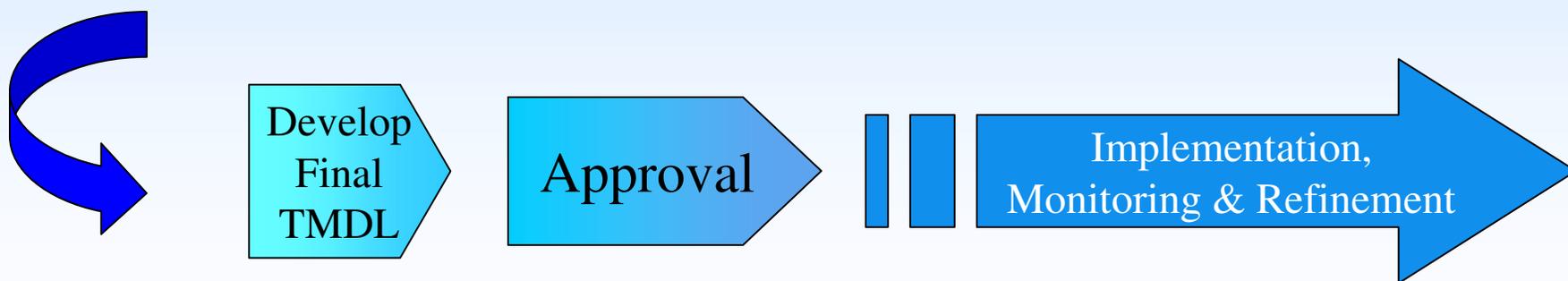
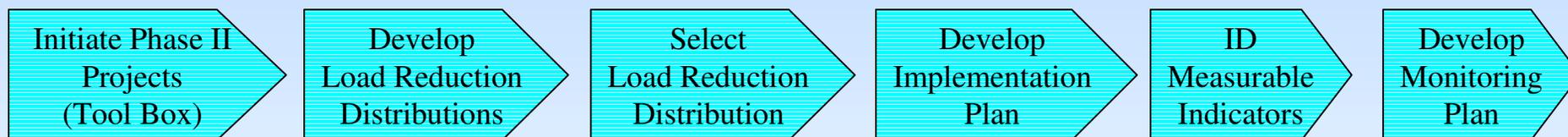
Lake Response

- UCD - Lake Tahoe Clarity Model (hydrodynamics, water quality, optical properties)

PHASE I



PHASE II

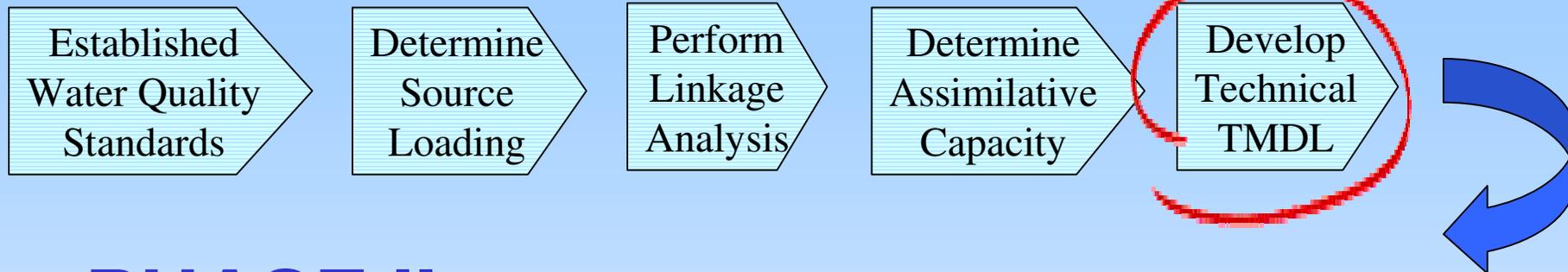


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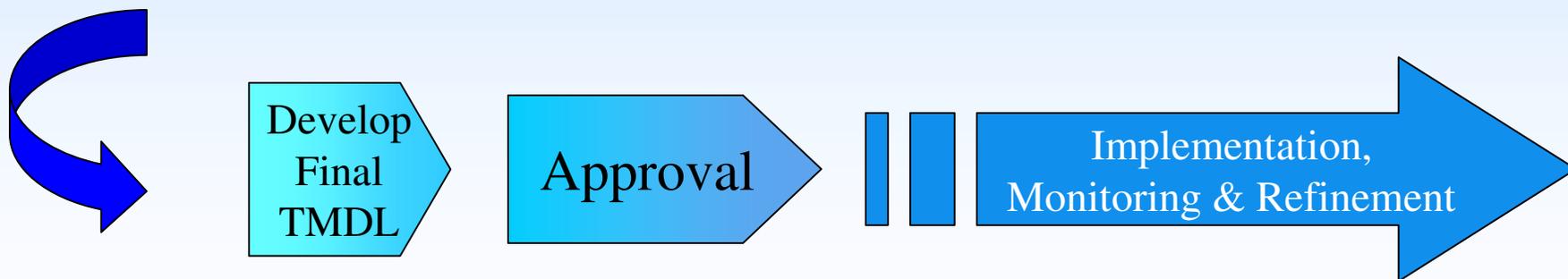
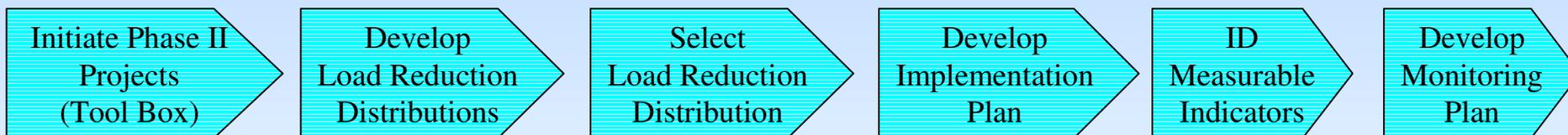
Assimilative Capacity

The amount of a contaminant load that can be discharged to a specific water body without exceeding water quality standards.

PHASE I



PHASE II



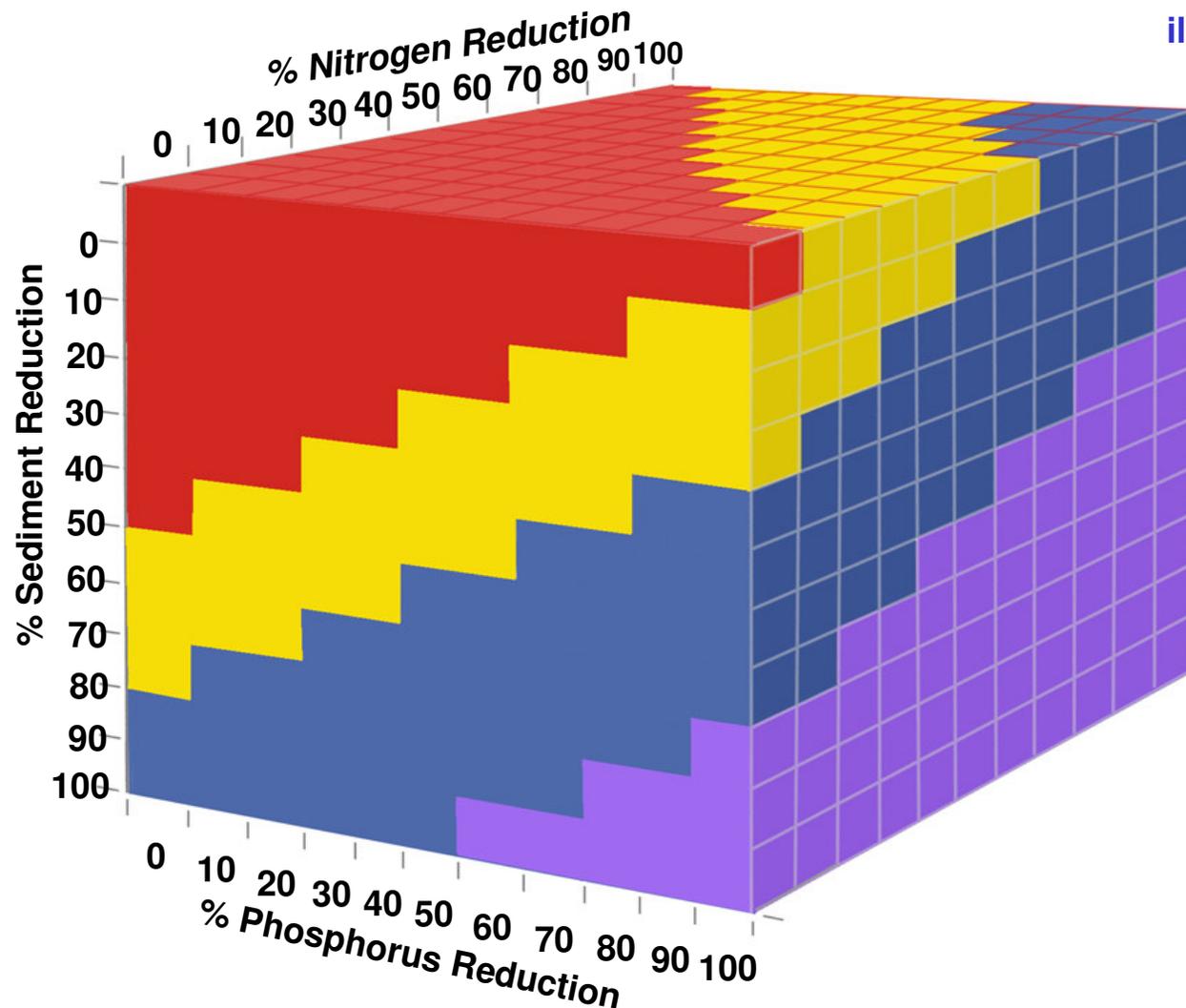
PHASE III

Technical TMDL

Primary Products:

- 1) Accurate estimation of current loading
- 2) Assimilative capacity = TMDL
- 3) Basis for establishing load reduction allocations and implementation planning
- 4) Provides range of constituent load reductions for achieving desired clarity

Conceptual Load Reduction Model



Parameters are for illustrative purposes only

**Final Secchi
Depth (m)**

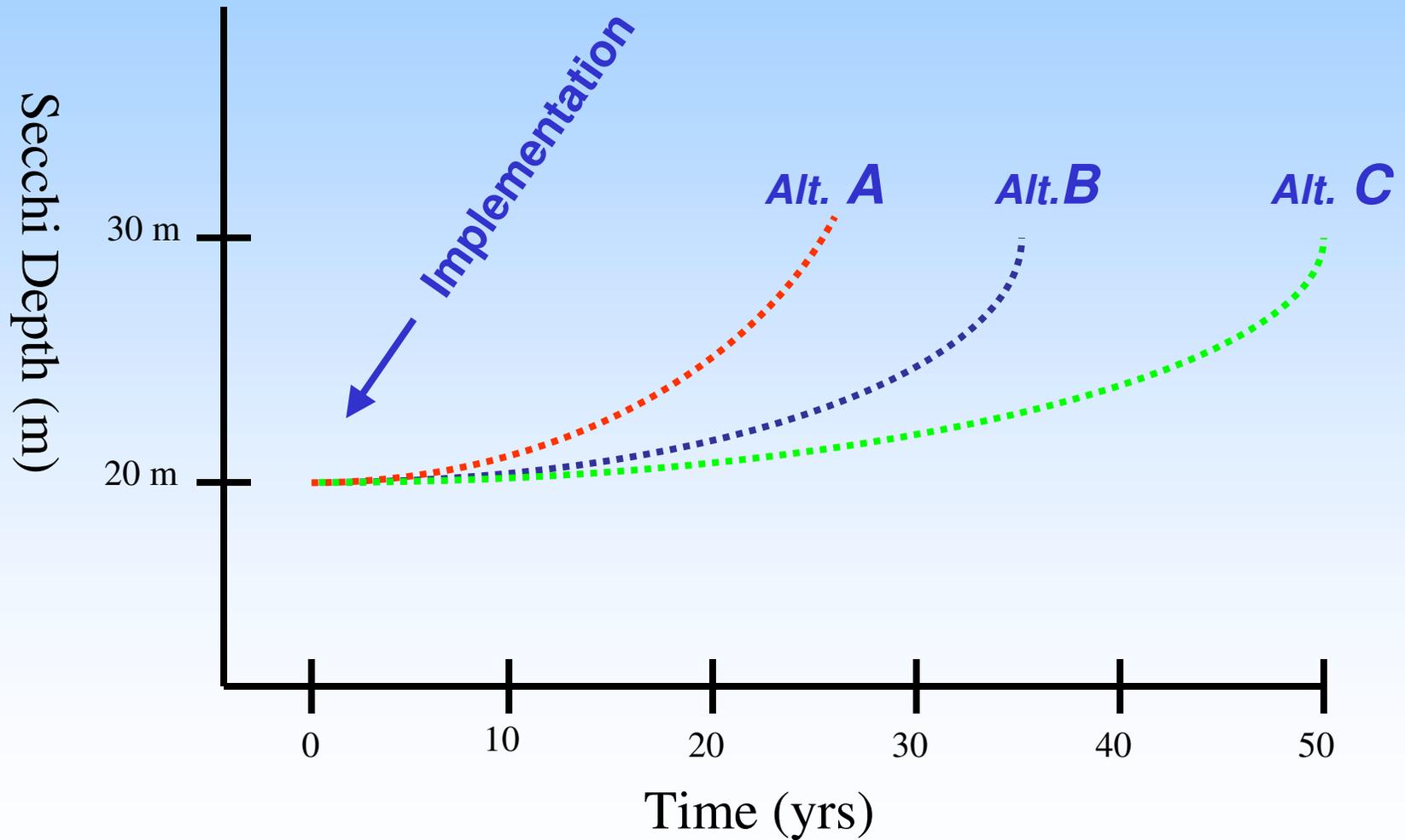
20- 25.....Red

25.5-28.....Yellow

28.5-32.5.....Blue

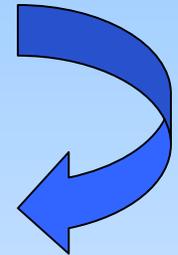
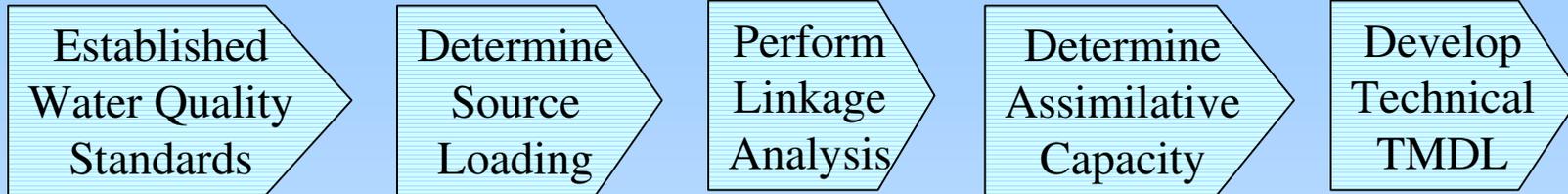
33 & above..Purple

Conceptual Clarity Improvement Curves

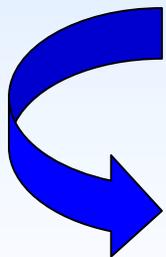


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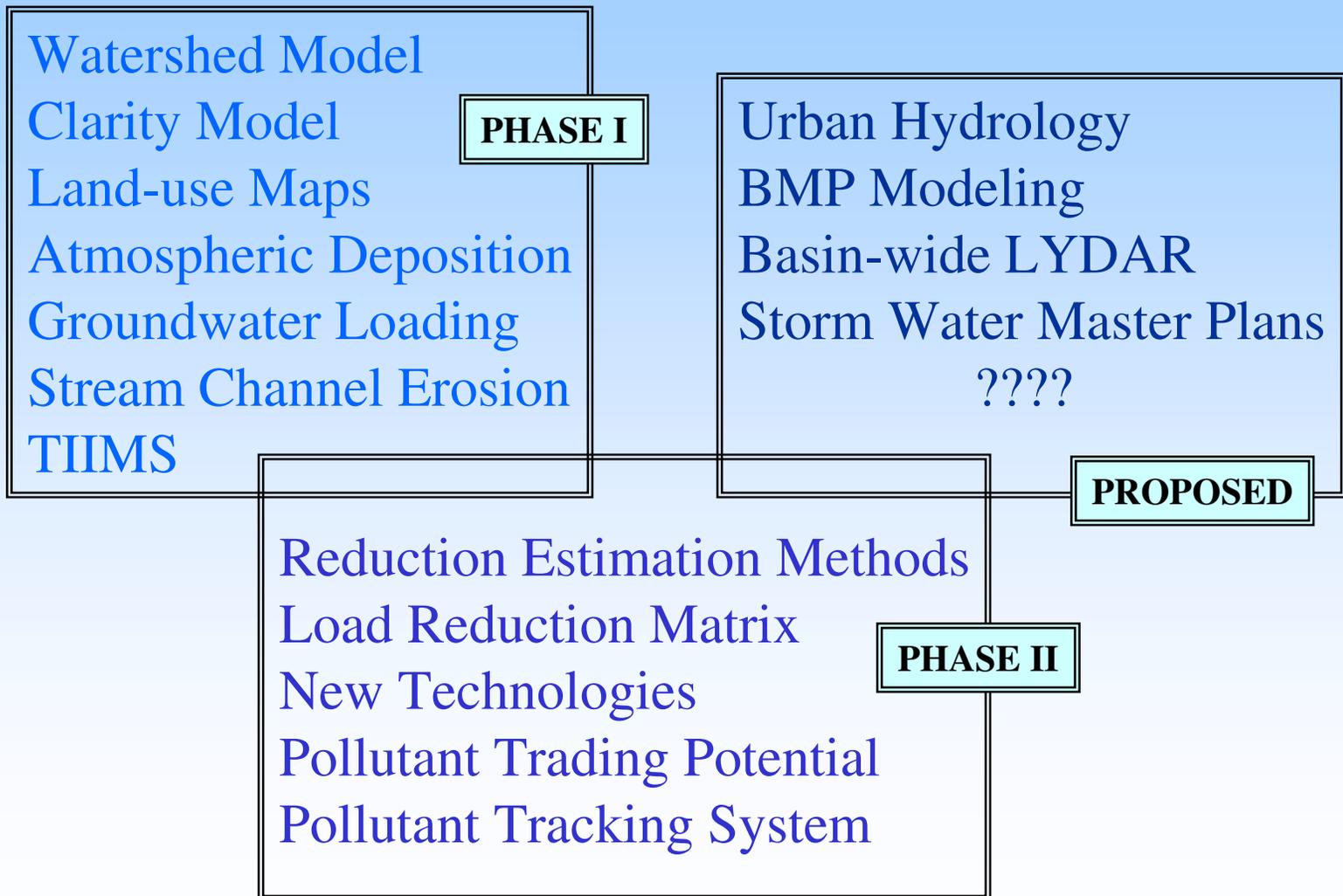


PHASE II



PHASE III

TMDL Implementation Tool Box

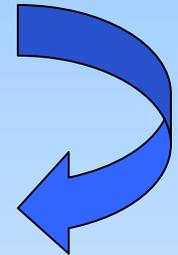
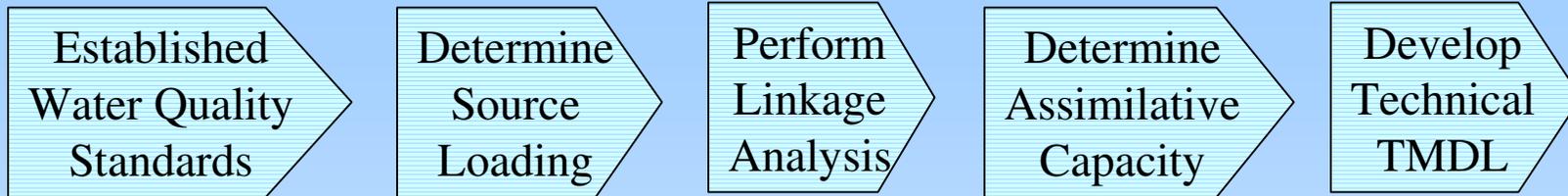


Example Load Reduction Matrix

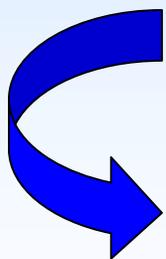
Load Reduction Opportunities		Effectiveness	Cost	Constraints	Etc.	Estimated Load Reduction
URBAN						
U-1	Infiltration	4	\$	2	tbd	xx kg/yr
U-2	Wetland Treatment	7	\$\$	7	tbd	xx kg/yr
U-3	Source Control	6	\$	1	tbd	xx kg/yr
U-4	Chemical Enhancement	9	\$\$\$	8	tbd	xx kg/yr
ATMOSPHERIC						
A-1	Vehicle Emission Control	4	\$\$	4	tbd	xx kg/yr
A-2	Wood Stove Management	5	\$\$	3	tbd	xx kg/yr
A-3	Out-of-Basin Source Control	2	\$\$\$	9	tbd	xx kg/yr
A-4	Dust Management	7	\$	2	tbd	xx kg/yr
STREAM CHANNELS						
ST-1	Stream Restoration	7	\$\$\$	5	tbd	xx kg/yr
ST-2	Bank Stabilization	7	\$\$	3	tbd	xx kg/yr
ST-3	Hydrological Controls	5	\$	2	tbd	xx kg/yr
GROUND WATER						
GW-1	Fertilizer Management	3	\$\$	7	tbd	xx kg/yr
GW-2	Source Control	8	\$	2	tbd	xx kg/yr
FORESTED AREAS						
FA-1	Road Management	6	\$\$\$	6	tbd	xx kg/yr
FA-2	Trail Management	5	\$\$	5	tbd	xx kg/yr
FA-3	Fire Restoration	7	\$\$	4	tbd	xx kg/yr
Total Possible Load Reduction						xx kg/yr

Parameters are for illustrative purposes only

PHASE I



PHASE II



PHASE III

Watershed Model

Land-use Classifications

Land Use Description	Pervious/Impervious	Subcategory Name	Number
Water Body	Impervious	Water_Body	1
Single Family Residential	Pervious	Residential_SFP	2
	Impervious	Residential_SFI	3
Multi Family Residential	Pervious	Residential_MFP	4
	Impervious	Residential_MFI	5
Commercial/Institutional/ Communications/Utilities	Pervious	CICU-Pervious	6
	Impervious	CICU-Impervious	7
	Impervious	Roads_Primary	8
Transportation	Impervious	Roads_Secondary	9
	Impervious	Roads_Unpaved	10
	Pervious	Ski_Areas-Pervious	11
Vegetated	Pervious	Veg_Unimpacted	12
	Pervious	Veg_Recreational	13
	Pervious	Veg_Burned	14
	Pervious	Veg_Harvest	15
	Pervious	Veg_Turf	16



Example Load Reduction Distributions

A

Urban (34%): U-2, U-6, U-14, U-26, U-56, U-78
Atmospheric (12 %): A-3, A-7, A19, A43
Stream Channels (20%): ST-10, ST-34, ST-43
Ground Water (12%): GW-2, GW-4, GW-18
Forested Areas (22%): FA-11, FA-23, FA-25

TOTAL REDUCTION = 15,000 kg tbd/yr

B

Urban (20%)
Atmospheric (25%)
Stream Channels (25%)
Ground Water (15%)
Forested Areas (15%)

**TOTAL REDUCTION =
15,000 kg tbd/yr**

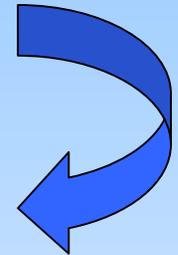
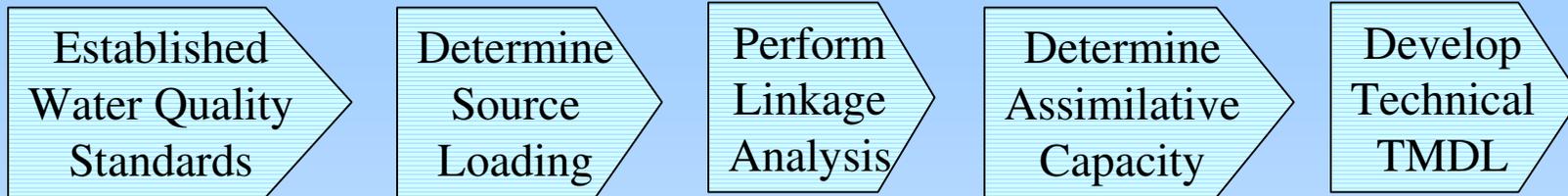
C

Urban (20%)
Atmospheric (15%)
Stream Channels (30%)
Ground Water (25%)
Forested Area (15%)

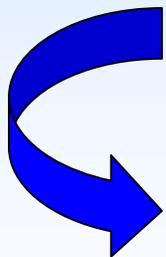
**TOTAL REDUCTION =
15,000 kg tbd/yr**

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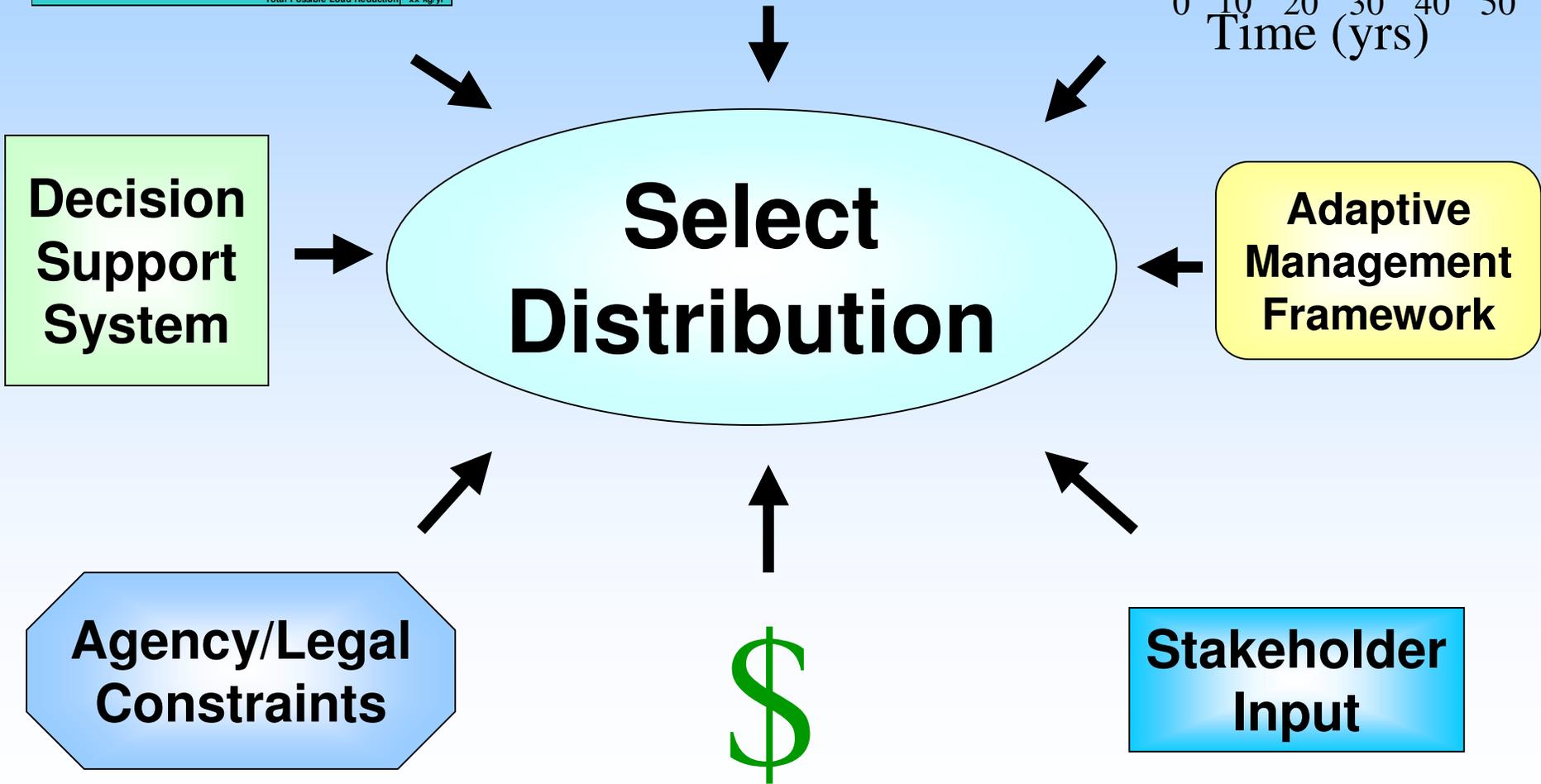
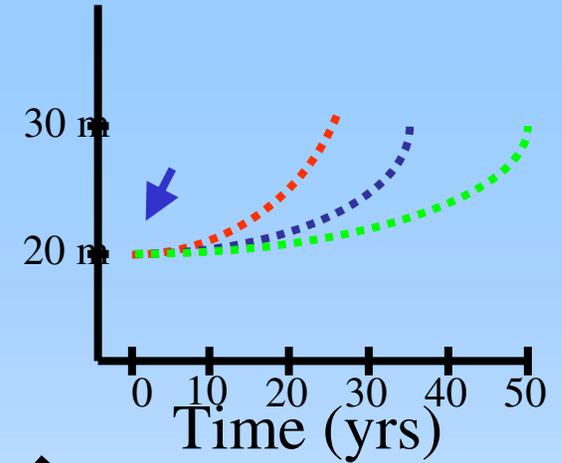
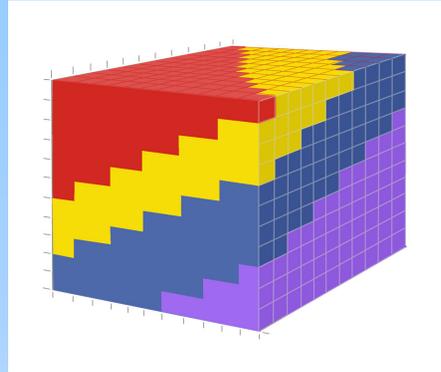


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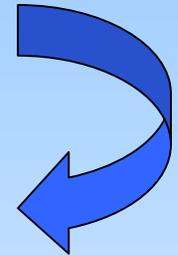
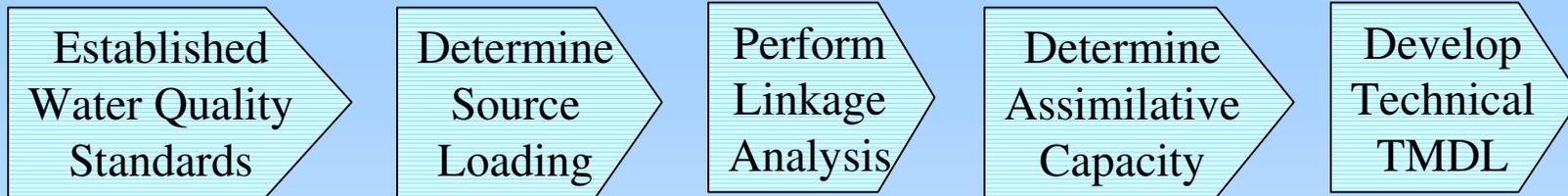


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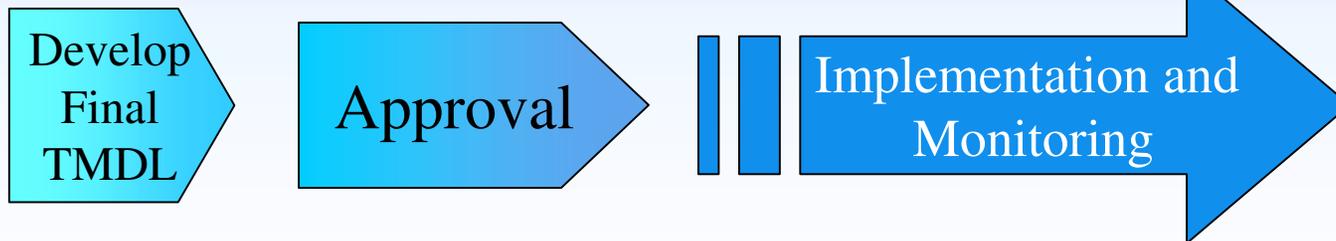
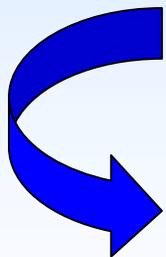
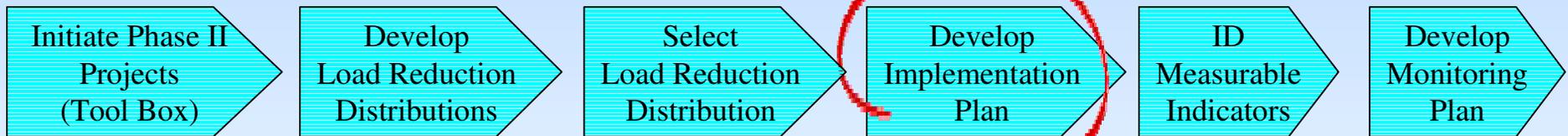
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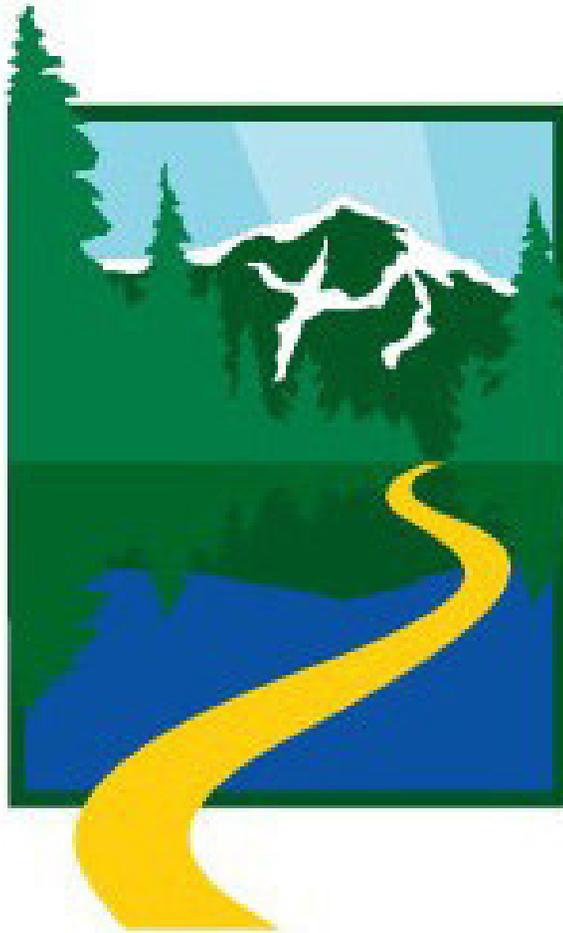
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PHASE II



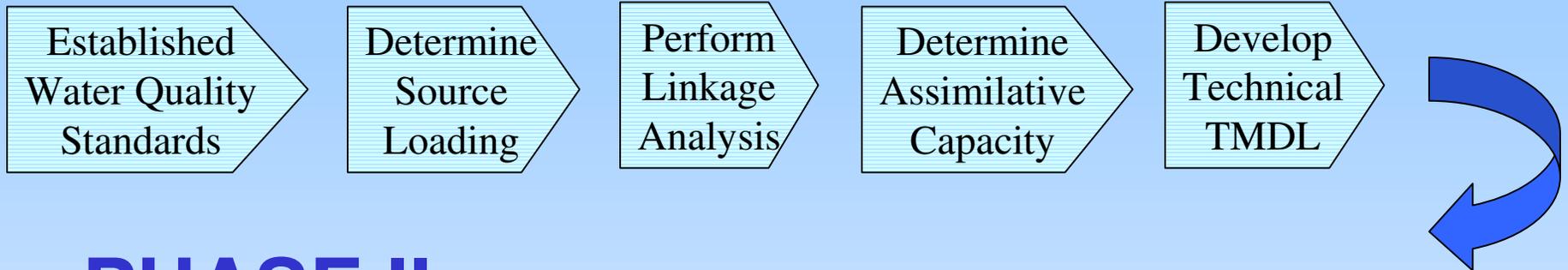
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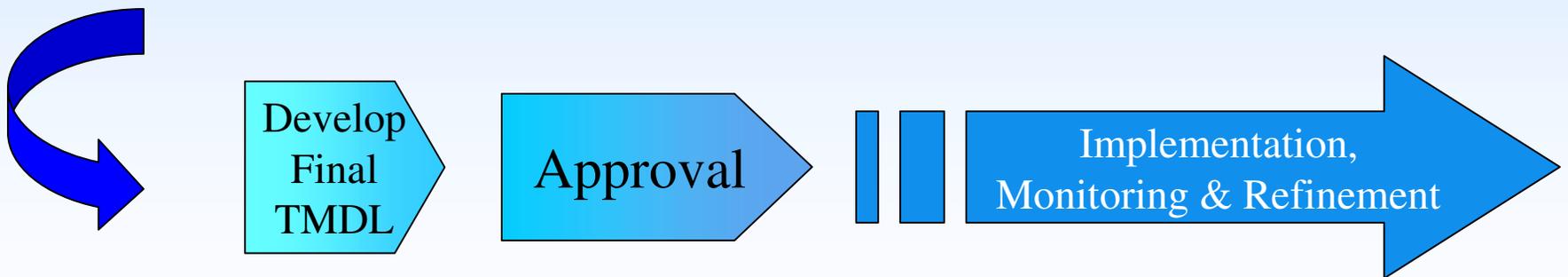
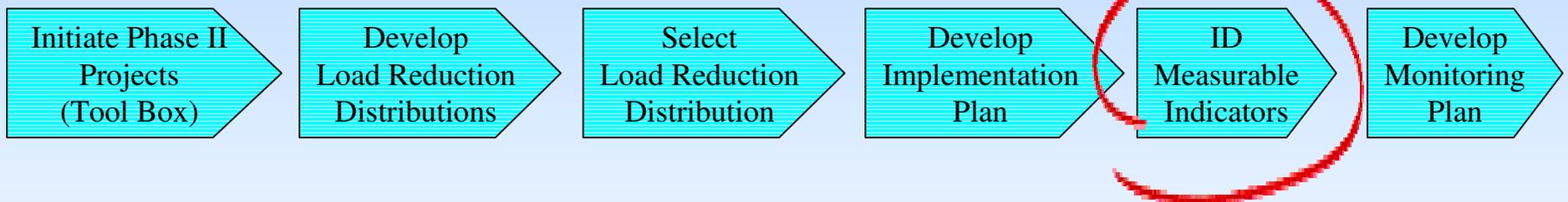
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A VISION FOR TAHOE'S FUTURE

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PHASE II



PHASE III

Indicators, Milestones and Objectives

Indicators

- Provide short-term measurable indicators of progress
- I.e. BMP performance, project load reductions

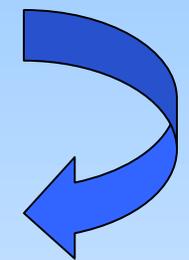
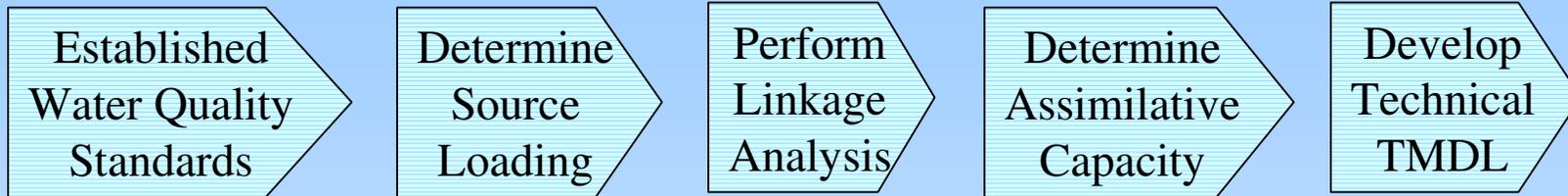
Milestones

- Sets measurable performance goals at predetermined time intervals
- Developed with linkage models
- I.e. Two/Five/Ten year load reduction goals, number of BMPs installed, funding goals

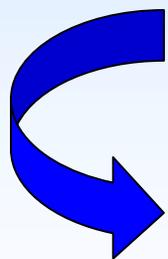
Objectives

- Long-term water quality goals
- Attainment of water quality goals and thresholds

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PHASE II

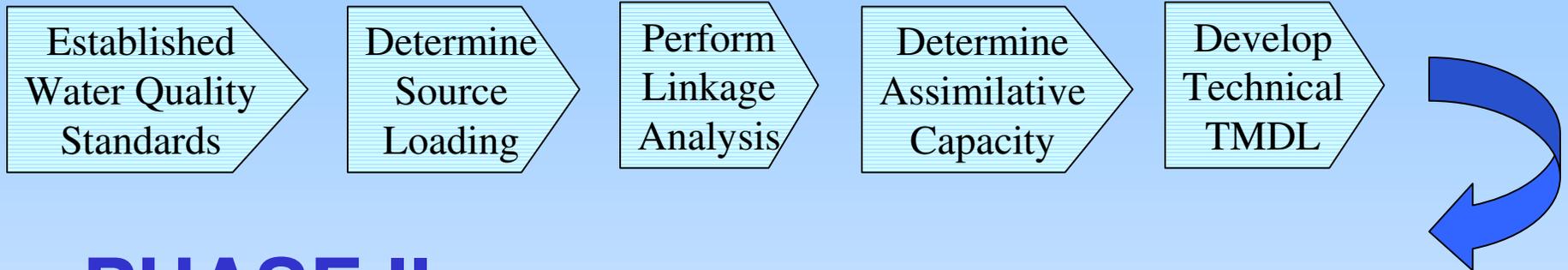


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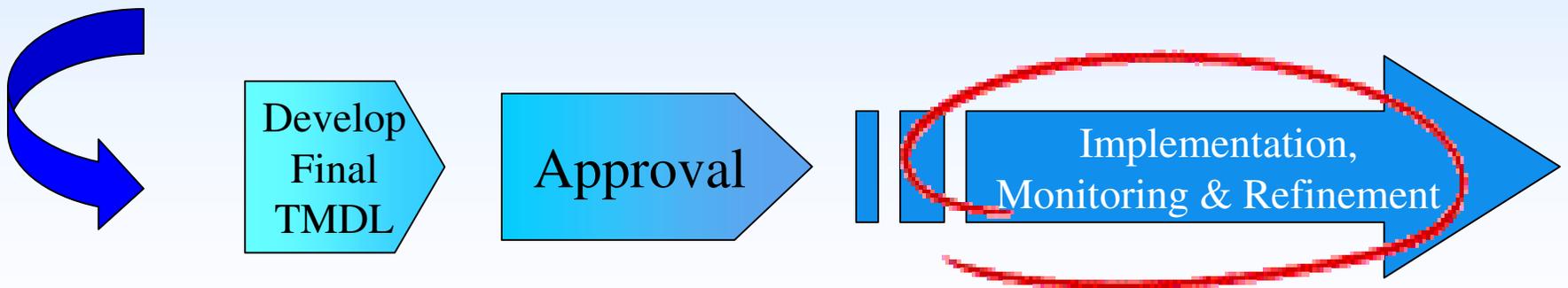
Monitoring Plan

- 1) Identify appropriate indicators and milestones***
- 2) Track source load reductions, indicators and milestones over time***
- 3) Account for variability***
- 4) Account for resource availability***
- 5) Integrative measures***

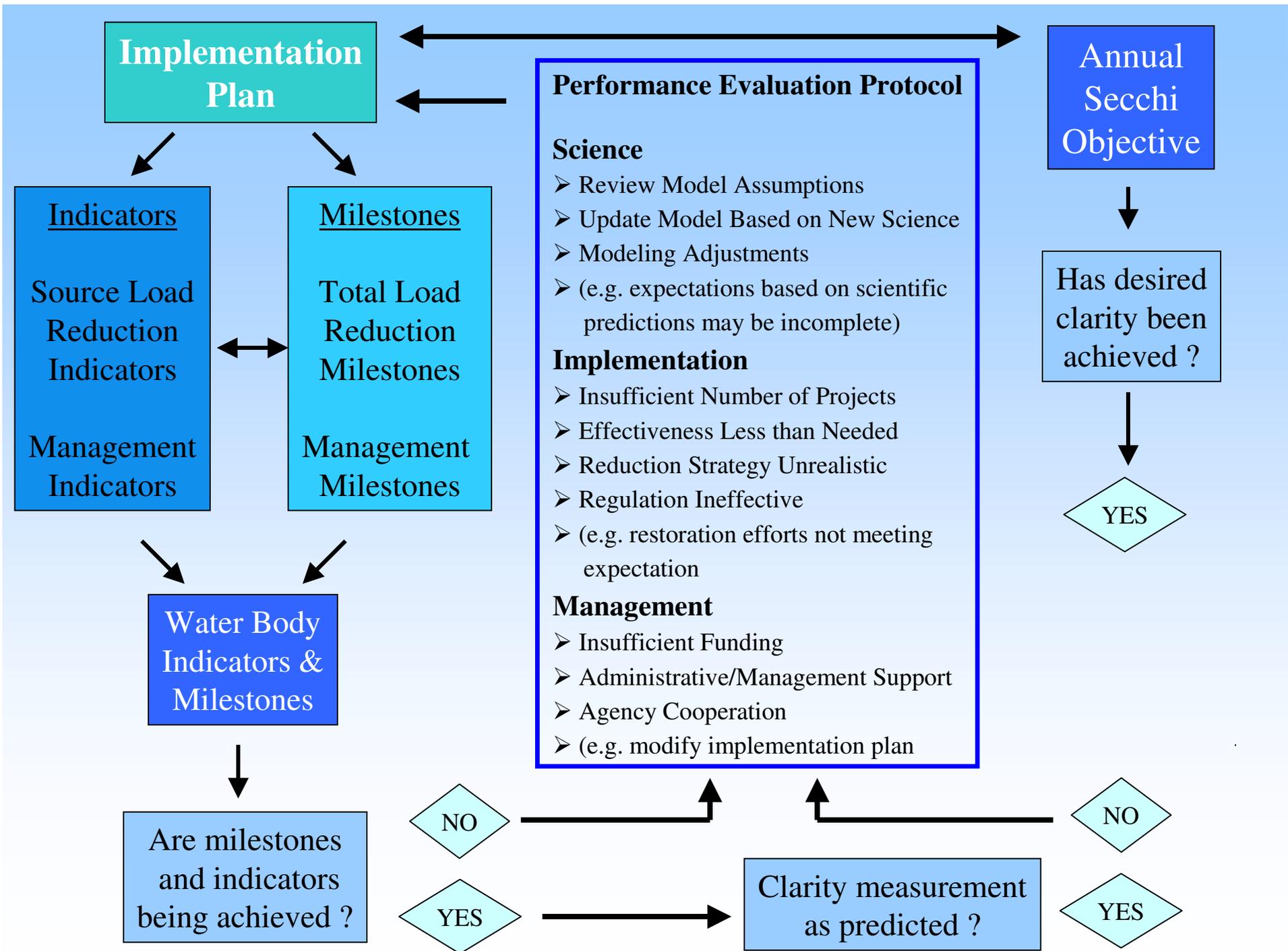
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PHASE II



PHASE III



Lake Tahoe TMDL Timeline

